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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Cushion Body, and Method and Apparatus for Making a  
Cushion Body

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(71) Same as inventor

(30) (DE) P 44 03 054.1 1994/01/28

(57) 53 Claims

Notice: This application is as filed and may therefore contain an  
incomplete specification.



## **ABSTRACT OF THE DISCLOSURE**

A cushion body, in particular for use as filler material in packagings or as corner protection and/or surface protection for objects being packaged, includes a section piece of a flat strip or sheet of paper or cardboard, formed to a spatial structure with shock-absorbing properties.

Fig. 1

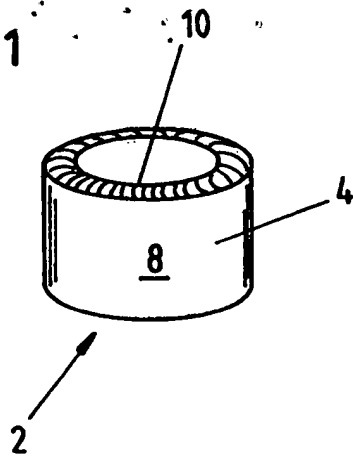


Fig. 2

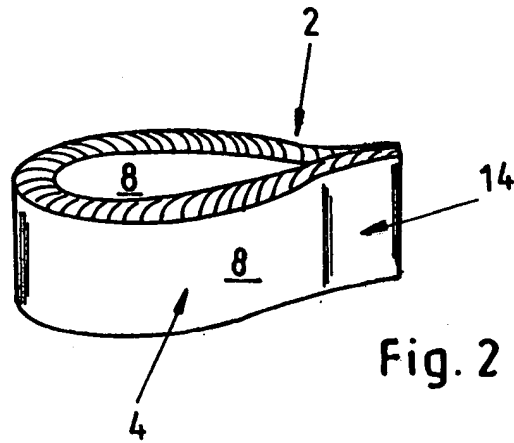


Fig. 3

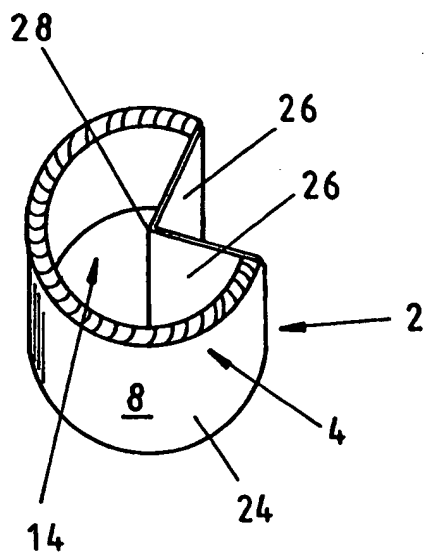
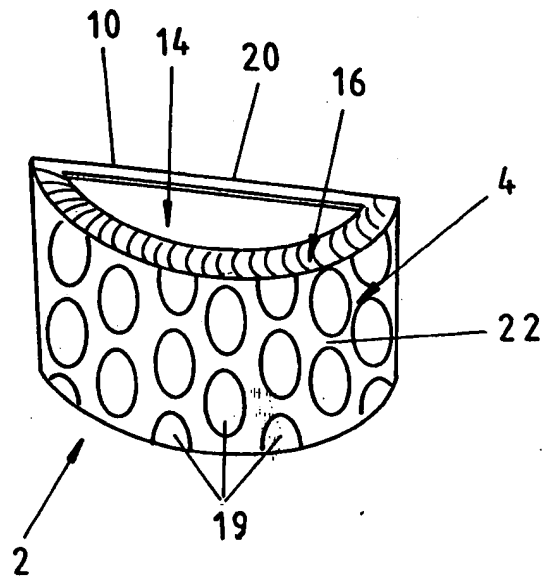


Fig. 4



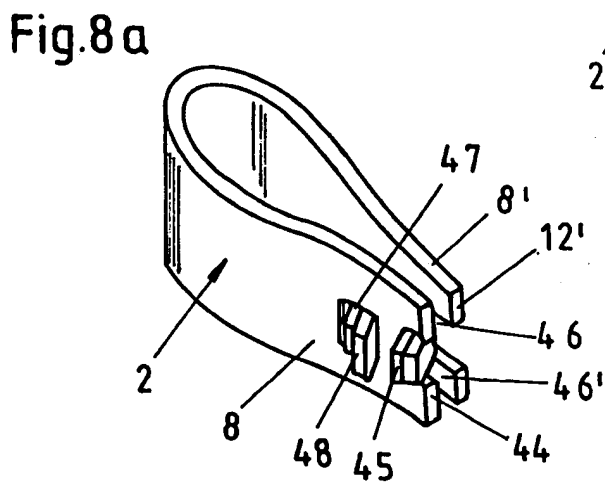
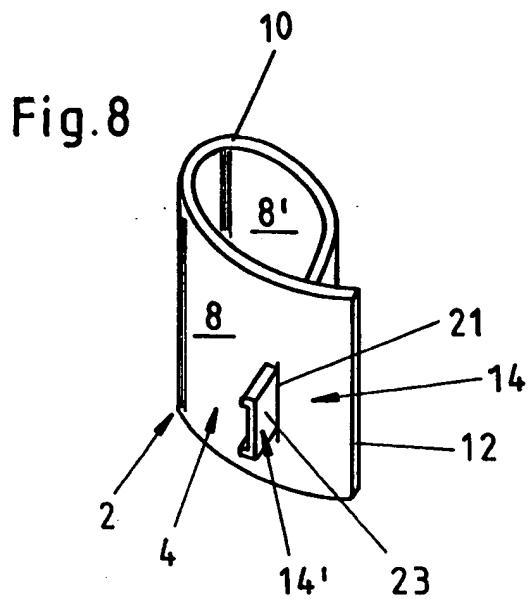
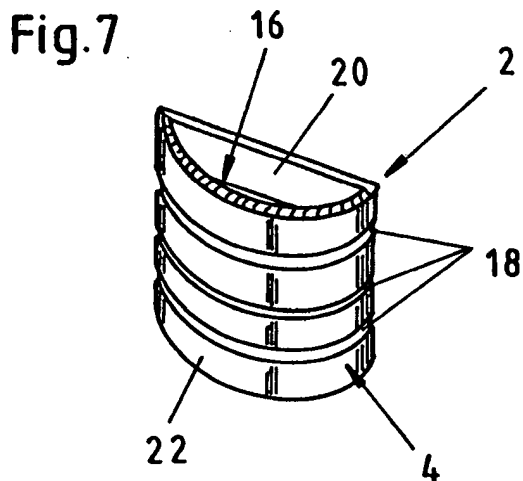
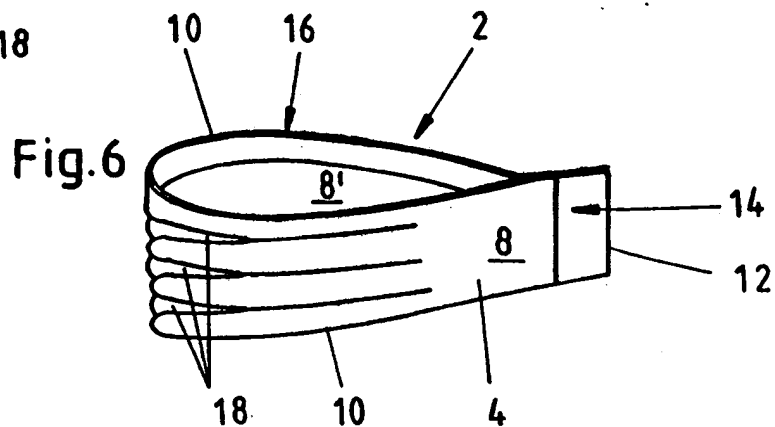
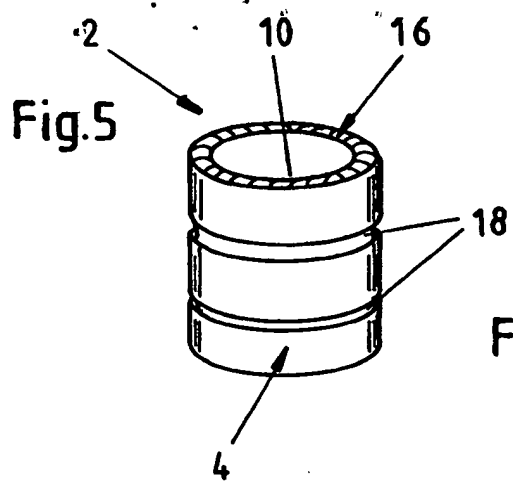


Fig.9

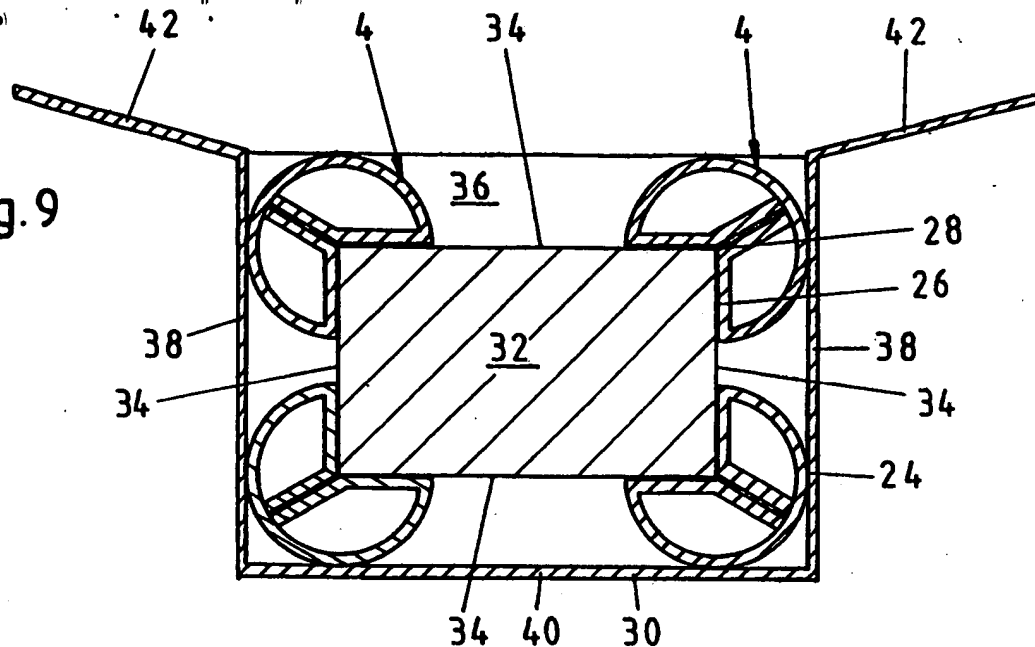


Fig.10

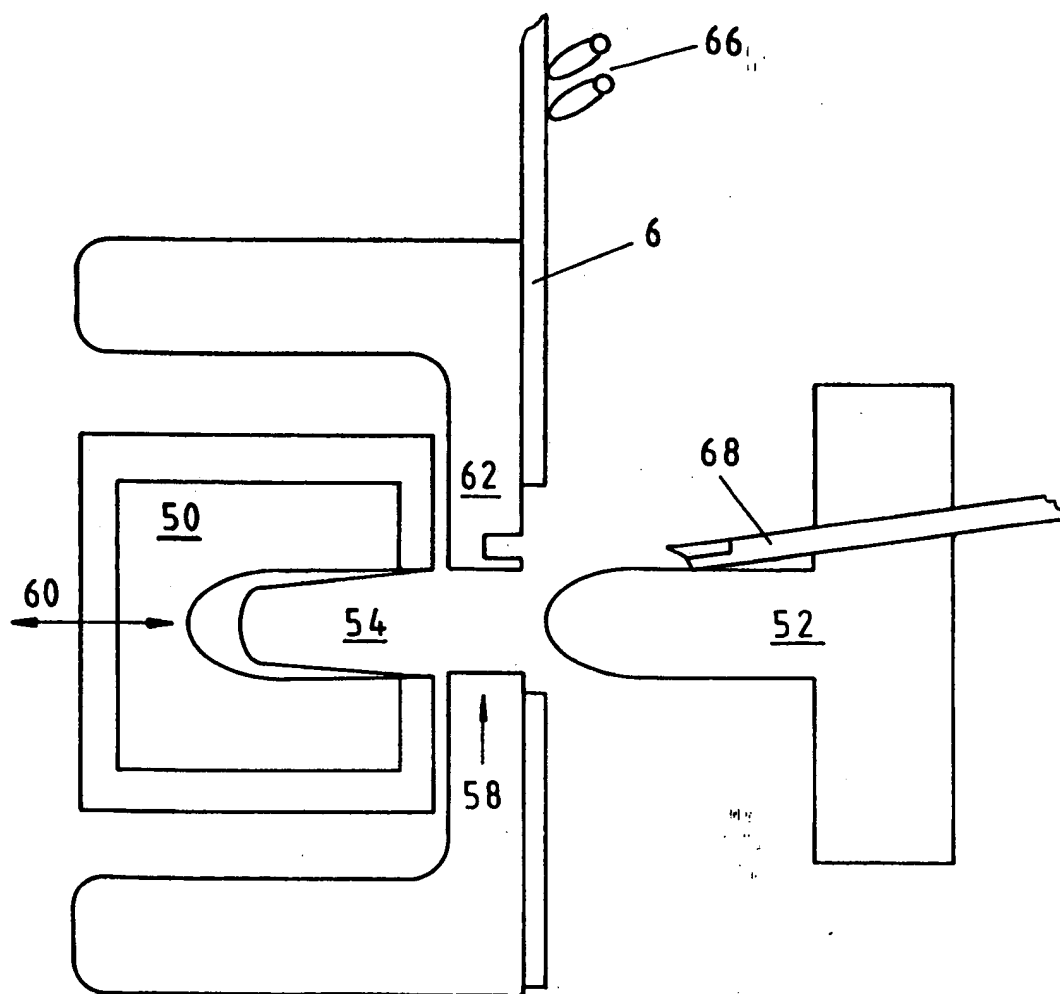
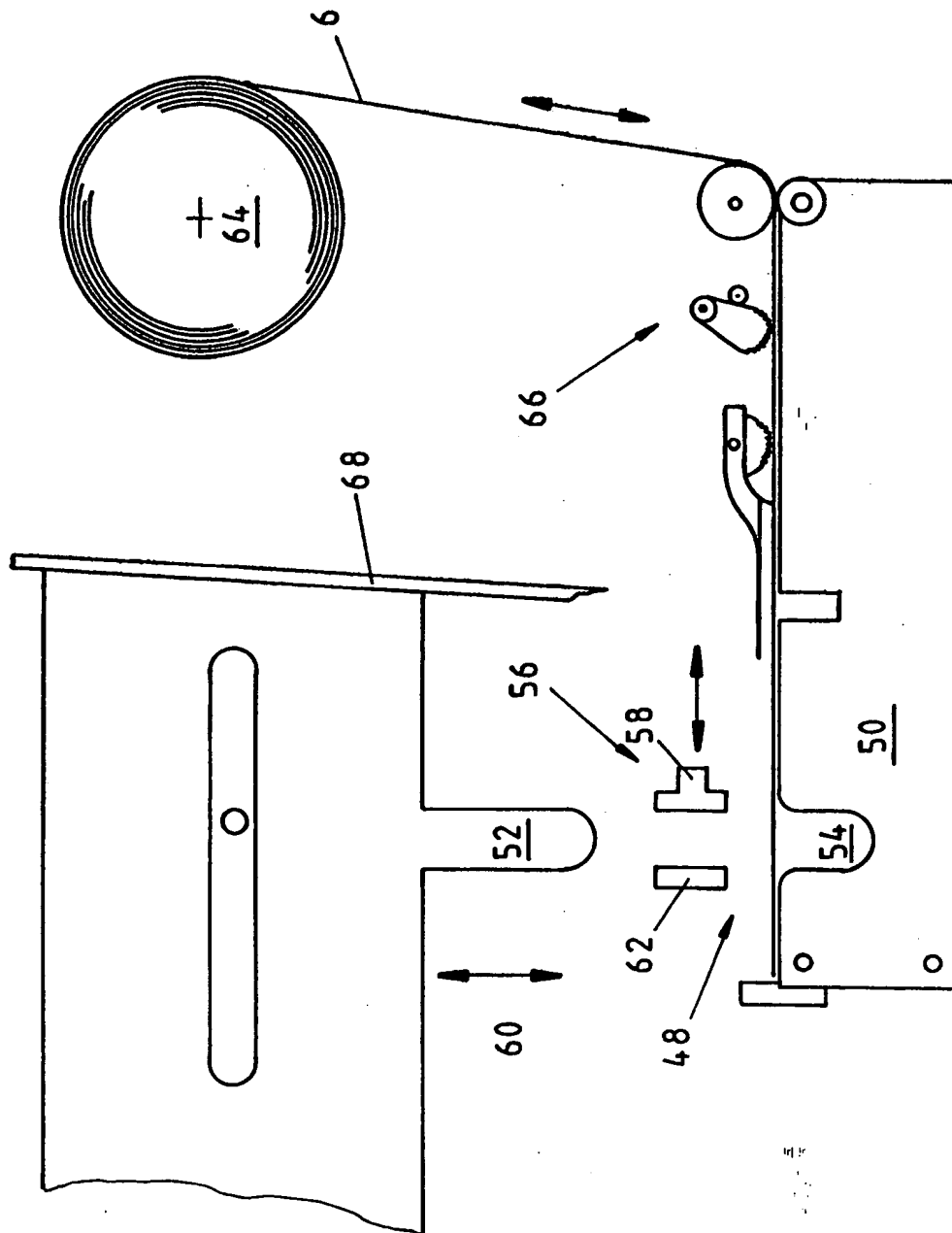


Fig.11



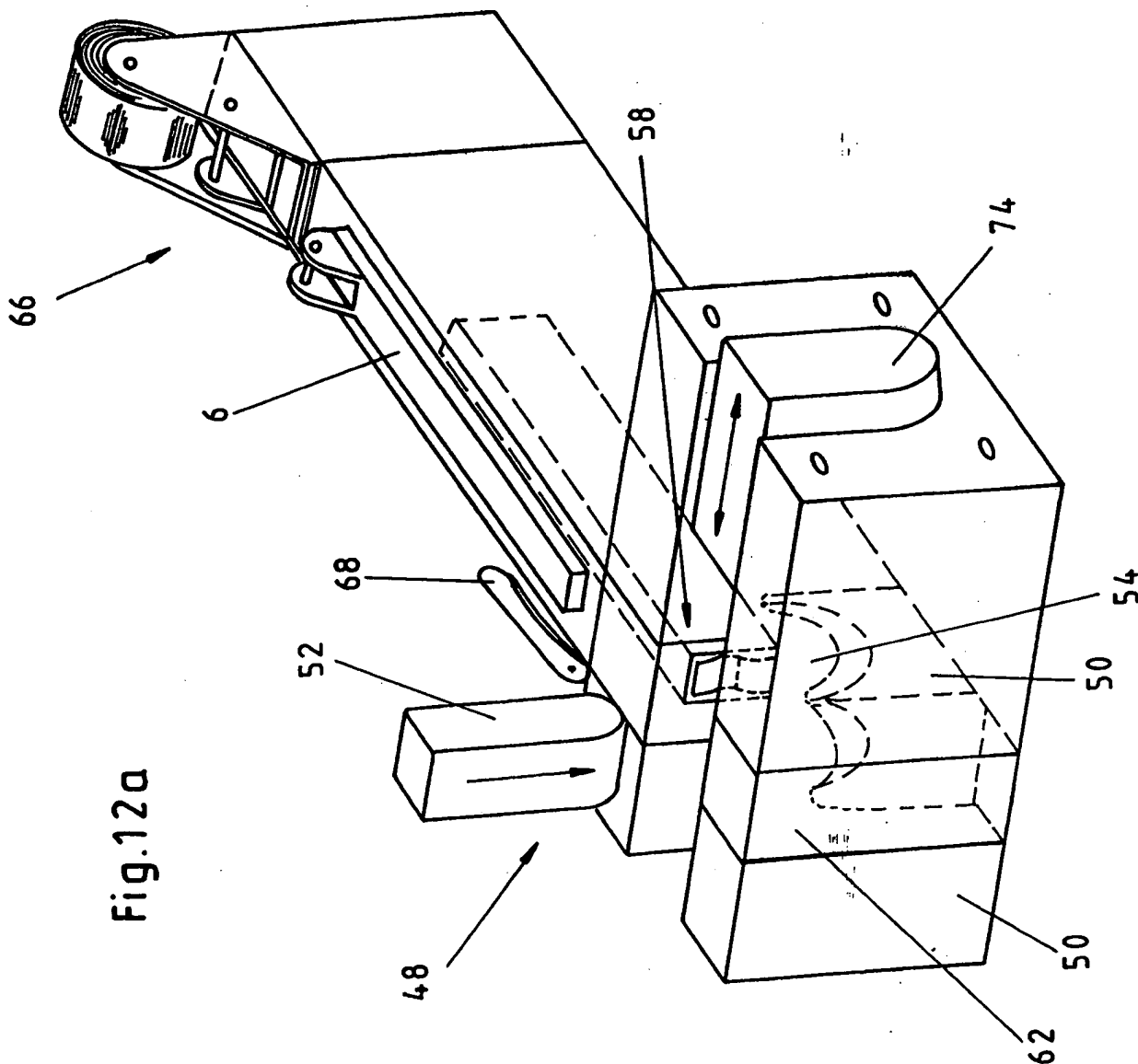


Fig. 12a

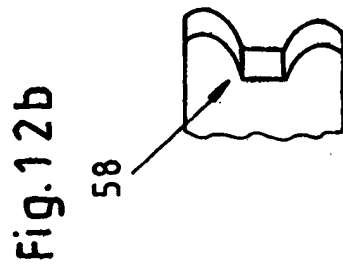


Fig. 12b

Fig. 1 is a schematic diagram of a mechanical assembly. It shows a base 50 with a curved surface 54. A component 52 is positioned above the base. A lever 6 is pivoted at 70 on the base. A spring 66 is attached to the lever. A component 68 is shown on the left. A dashed line 72 indicates a path or boundary. Arrows indicate movement or force.

51. 1 1 0. 0





Fig. 16

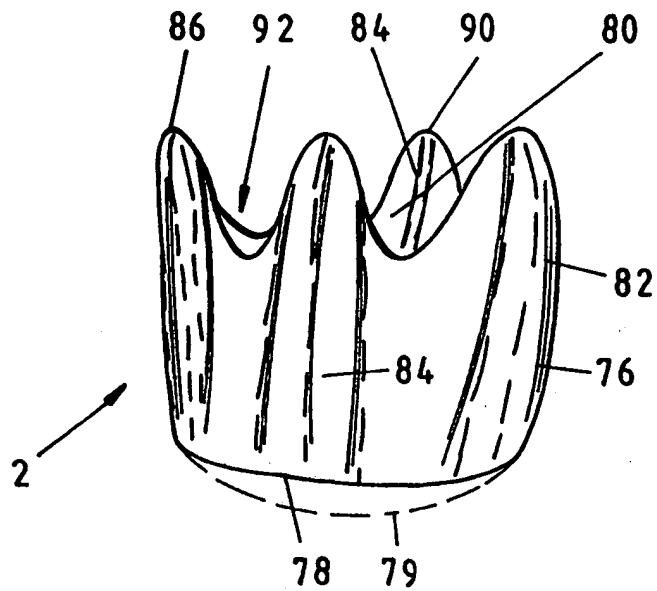


Fig. 15

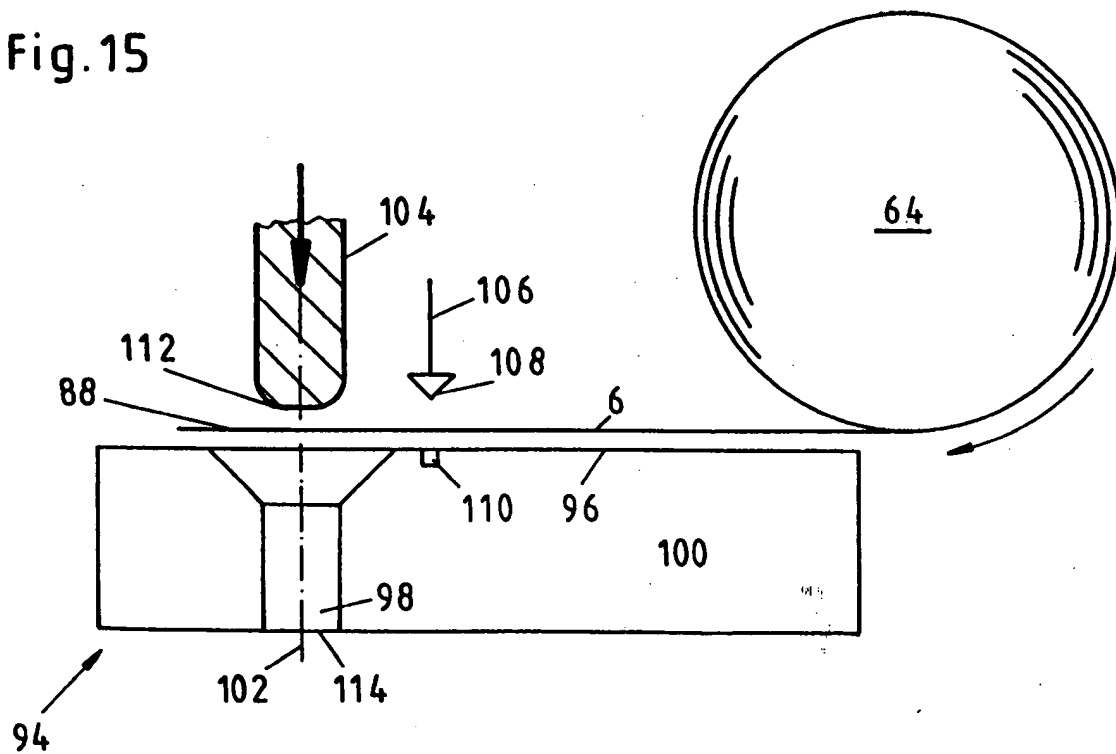


Fig. 17

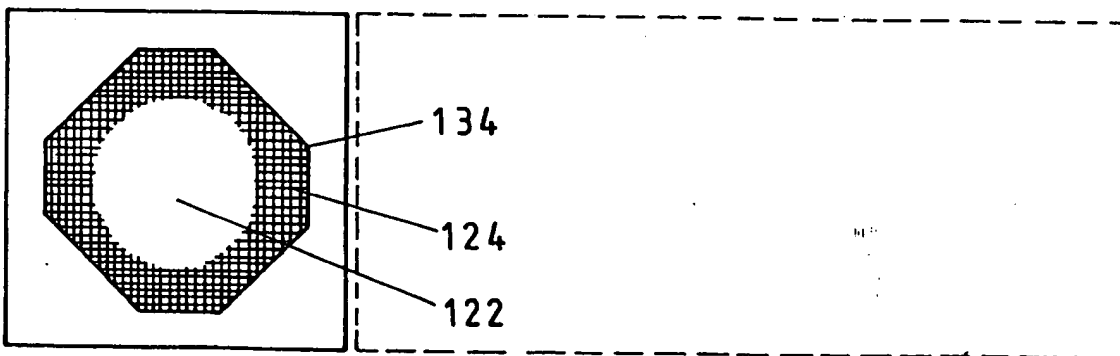
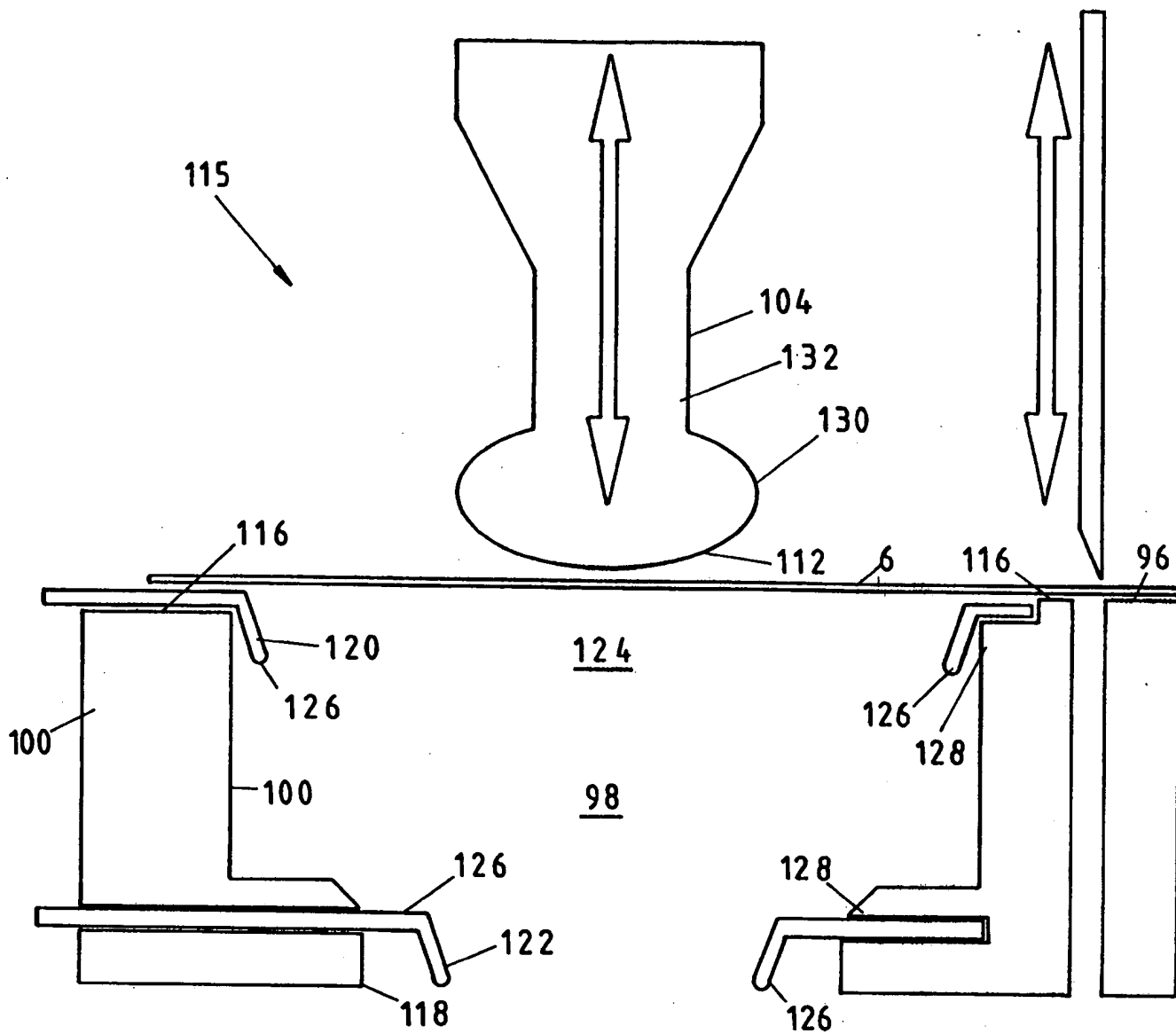
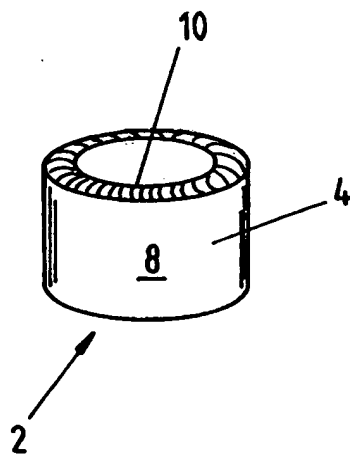


Fig. 18



1       **CUSHION BODY, AND METHOD AND APPARATUS FOR MAKING A**  
2                                   **CUSHION BODY**

3  
4  
5  
6                                   **BACKGROUND OF THE INVENTION**

7  
8       The present invention refers to a cushion body, in particular for use as filler  
9       material in packagings or as edge protection and/or surface protection for objects to  
10      be packaged, as well as to a method and an apparatus for making such a cushion  
11      body.

12  
13      Cushion bodies made of foamed plastic material are commonly used for  
14      protecting objects being packaged as well as for fitting these objects in boxes or  
15      other packaging containers of given dimensions. These cushion bodies are either of  
16      small size, e.g. in form of flat shells or repeatedly bent rods which allow irregularly  
17      shaped hollow spaces between the object and the packaging container to be filled,  
18      or these cushion bodies may be formed as larger shaped bodies which are matched  
19      to the configuration of the object being packaged and the interior space of the  
20      packaging container for immobilizing the object in the desired position and to protect  
21      the object from shocks.

1           A problem related to the use of such cushion bodies is their difficult disposal  
2 because a recycling can only be considered when the materials are separated from  
3 each other and collected according to their grades. This is not or rarely possible  
4 especially as far as the end consumer is concerned. But even industrial consumers  
5 encounter problems since the spatial need for foamed plastic materials is very great,  
6 thus necessitating either large storage capacities or a rapid removal cycle.

7

8           Moreover, the use of cushion bodies of foamed plastic material is also  
9 disadvantageous for packaging plant because these materials must be ordered from  
10 special manufacturers and ,for cost-saving reasons, shipped in large amounts to  
11 reduce expenses, resulting again in increased storage costs for the packaging  
12 plant.

13

#### 14                                   **SUMMARY OF THE INVENTION**

15

16           It is an object of the present invention to provide an improved cushion body  
17 obviating the aforestated drawbacks.

18

19           In particular It is an object of the present invention to provide an improved  
20 cushion body which can be made from disposable material in a simple manner.

1        It is yet another object of the present invention to provide a method for  
2 making cushion bodies which are easily disposable and essentially eliminate the  
3 need for storage.

4

5        It is still another object of the present invention to provide an apparatus for  
6 making such cushion bodies.

7

8        These objects and others which will become apparent hereinafter are  
9 attained in accordance with the present invention by forming the cushion body from  
10 a section piece of a flat strip or sheet of paper or cardboard which is shaped to a  
11 three-dimensional spatial structure with shock-absorbing properties.

12

13        Through provision of cushion bodies according to the present invention, the  
14 objects being packaged are surrounded while being protected during shipment.  
15 After use, the cushion bodies are easily disposable together with the other  
16 packaging material and collected for paper recycling.

17

18        In accordance with a preferred feature of the present invention, the structure  
19 is elastically deformable to a limited degree so as to provide the cushion body with  
20 good shock-absorbing properties, whereby the section piece is advantageously  
21 biased to counter the deformation. In this manner, the structure resists a

1 deformation when subjected to pressure loads or shocks while giving way at greater  
2 pressure loads or shocks to thereby attenuate through its deformation the impact.  
3 Once the pressure load or shock impact is removed, the elastic restoring force  
4 reverts the structure to its original shape.

5

6 In accordance with a further preferred feature of the present invention, the  
7 section piece is provided with a sufficient prestress by bending the structure in such  
8 a manner that its radius of curvature enlarges at least over a certain area when  
9 being subjected to a pressure load or shock impact.

10

11 According to yet another feature of the present invention, the section piece is  
12 prevented from snapping along the significantly bent areas by providing the strip  
13 upon which the section piece is based with increased ductility and/or greater flexural  
14 strength. A greater ductility can be accomplished by increasing e.g. the fraction of  
15 glue binder in the paper or in the cardboard while an increased flexural strength can  
16 be effected by e.g. beading, folding, pressing or like shaping of at least one rim area  
17 of the section piece, preferably inwardly towards the center of the radius of  
18 curvature.

19



1        Moreover, the strip or the section piece may be embossed with depressions  
2        which are suitably offset to each other in longitudinal direction of the strip or the  
3        section piece and also counter a snapping of the paper or of the cardboard.

4        The cushion body displays especially good shock-absorbing properties when  
5        having a cross section in form of an enclosed outline parallel to the plane of  
6        curvature, i.e. when both ends of the section piece are joined together so that a  
7        closed ring with a central eye is created. Such ring-shaped structures are capable to  
8        fill a large hollow space volume while still being of relatively small weight so that  
9        shipping expenses can be reduced.

10

11        A secure joint is effected by overlapping the ends of the section piece,  
12        preferably by either having the opposing broadsides overlapping each other so that  
13        the structure has an essentially ring-shaped outline, or by overlapping two opposing  
14        rim areas of one broadside so that the structure has a guttiform configuration or  
15        drop-shaped outline. The overlapping parts can be joined through gluing, tacking or  
16        impressing.

17

18        Theoretically, it is also possible to detachably secure the overlapping ends,  
19        e.g. by suitably forming one end as tab which is guided through a recess of the  
20        other end and cut to shape to attain an interlocking connection.

21

1           A limited deformability of the ring-shaped structure transversely to the plane  
2 of curvature of the section piece can be attained in accordance with a further  
3 feature of the present invention by providing at least one score longitudinally in  
4 direction of the strip or section piece by which a certain compression of the  
5 structure in a bellows-type manner transversely to the plane of curvature is  
6 permitted.

7  
8           In accordance with a further feature of the present invention for use of the  
9 cushion body as a edge (corner) protection or surface protection, the outline of the  
10 structure corresponds to a segment of a circle which has an angle at center of  
11 preferably  $270^\circ$  as corner protection for rectangular edges of an object, and of  
12 suitably  $180^\circ$  when employed as a surface protection. At use of the cushion body  
13 as surface protection, the ends of the arched section part are connected together by  
14 a straight section part which thus forms the chord of the semi-circle . For use as  
15 edge protection, the ends of the arched section piece are preferably connected by  
16 two section parts which abut each other perpendicular in the center of the circle and  
17 extend from the center in parallel relationship towards the arched section part, with  
18 the adjoining ends of the two section parts bearing upon the inside wall surface of  
19 the arched section part and with their adjoining broadsides being connected  
20 together through gluing, tacking or impressing.

21

1           A method according to the present invention for making a cushion body of  
2 the above-described type includes forming a section piece separated from a flat  
3 strip or sheet of paper or cardboard into a three-dimensional structure with shock-  
4 absorbing properties. This method is simple and does not require complex  
5 components so that the cushion body can be produced from paper and

1 cardboard for the first time on site at the packaging plant.

2

3 Preferably the section piece for making a cushion body according to the  
4 invention is supplied prior to the shaping thereof through withdrawal from a  
5 magazine, or through separation from the free end of a rolled-up strip, or through  
6 blanking from a sheet. Subsequently, the section piece is bent in a shaping step  
7 transversely to its longitudinal direction at one of its broadsides in a U-shaped  
8 manner and the opposing ends of this one broadside are connected together. At the  
9 same time, one rim area can be flanged, score lines can be applied and/or  
10 depressions can be formed.

11

12 After connecting the ends, the finished cushion body is preferably  
13 discharged by an ejector into a storage container.

14

15 An apparatus for making a cushion body according to the invention includes  
16 at least one mold with two mold parts which are movable towards each other for  
17 shaping a prepared section piece of a strip or sheet of paper or cardboard. The mold  
18 parts are configured in such a manner that the structure formed by the mold is of  
19 the desired three-dimensional shape with shock-absorbing properties.

20

21 In accordance with a preferred embodiment of the present invention, one

1 of the mold parts is designed as female mold with a cavity, with the other mold part  
2 being designed as ram by which the section piece is pressed into the cavity of the  
3 female mold and against the surface of the cavity to thereby bend the section piece.  
4 The ram has a surface which complements the opposing surface of the cavity and  
5 is configured, in accordance with an advantageous feature of the present invention,  
6 such that the section piece is provided during the bending step at the same time  
7 with depressions and/or score lines and/or at least is partially flanged along its rim.  
8 Beading of the rim is suitably effected by providing the cavity with a slightly smaller  
9 width than the section piece and a slightly greater width than the ram so that one  
10 longitudinal rim or both longitudinal rims of the section piece are bent inside the  
11 space between the ram and the cavity and provided with a beading in along the rim  
12 area.

13  
14 In accordance with a further preferred embodiment of the invention, the  
15 apparatus includes at least one tacking tool which is arranged in the area of the  
16 ends of the bent section part pressed into the cavity, and, after retraction of the ram,  
17 is slideable or tiltable transversely to the direction of travel of the ram in order to  
18 press the ends of the section piece against each other and to glue them together or  
19 to impress them together, or to guide a tab arranged on one end of the section piece  
20 through a slot at the other end of the section piece.

21  
22 The apparatus may either include a magazine for receiving section pieces

1 which are suitably punched out in a preceding device from a web or a sheet of  
2 paper or cardboard, with the magazine preferably being designed as changing  
3 magazine. Alternatively, it is also possible to provide a take-off reel for rolled-up  
4 strips of paper or cardboard from which the strip is reeled off and supplied by means  
5 of a controllable feed unit to a knife for severing from the strip a section piece for  
6 subsequent shaping.

7

# 8 **BRIEF DESCRIPTION OF THE DRAWING**

9

10 The above and other objects, features and advantages of the present  
11 invention will now be described in more detail with reference to the accompanying  
12 drawing in which:

13

14 FIG. 1 is a perspective illustration of a cylindrical cushion body  
15 according to the present invention;

16

17 FIG. 2 is a perspective illustration of a cushion body according to the  
18 present invention with guttiform cross section;

19

20 FIG. 3 is a perspective illustration of a cushion body according to the  
21 present invention for use as corner protection;

1           FIG. 4           is a perspective illustration of a cushion body according to the  
2 present invention for use as surface protection;

3

4           FIG. 5           is a perspective illustration of a modified cylindrical cushion  
5 body according to the present invention;

6

7           FIG. 6           is a perspective illustration of a further cushion body according  
8 to the present invention with guttiform cross section;

9

10          FIG. 7           is a perspective illustration of a further cushion body according  
11 to the present invention for use as surface protection;

12

13          FIG. 8, 8a, 8b       are perspective illustrations of further cushion bodies  
14 according to the present invention;

15

16          FIG. 9           is a cross sectional view of one packaging container provided  
17 with four cushion bodies according to the present invention to protect the corners of  
18 an object being packaged;

19

20          FIG. 10           is a schematic side view of an apparatus according to the  
21 present invention for making a cushion body;

1           FIG. 11        is a schematic side view of a further apparatus for making a  
2 cushion body;

3

4           FIG. 12a     is a perspective illustration of still a further apparatus for  
5 making a cushion body;

6

7           FIG. 12b     is a perspective illustration of one end face of a pressure die or  
8 hob of a tacking tool of the apparatus according to FIG. 12a;

9

10          FIG. 13       is a schematic side view of a further apparatus for making a  
11 cushion body according to the invention;

12

13          FIG. 14       is a schematic side illustration of an apparatus for making  
14 strips or strands;

15

16          FIG. 15       is a schematic side view of an shaping unit;

17

18          FIG. 16       is a perspective illustration of a further cushion body according  
19 to the present invention;

20



- 1        FIG. 17        is a schematic side view of a further apparatus for making
- 2        cushion bodies according to the present invention; and

1           FIG. 18       is a top view upon a chase of the apparatus according to FIG.  
2 17.

3  
4           **DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**  
5

6           Throughout all the Figures, the same or corresponding elements are  
7 generally indicated by the same reference numerals.

8  
9           Turning now to the drawing, and in particular to FIGS. 1 to 8, there are  
10 shown various embodiments of a cushion body according to the present invention,  
11 generally designated by reference numeral 2. The cushion body 2 is formed from a  
12 section piece 4 which is separated from a flat strip 6 (see e.g. FIG. 10) of paper or  
13 cardboard and shaped to a three-dimensional spatial structure with shock-absorbing  
14 properties. The section piece 4 used for forming the cushion body 2 is initially flat  
15 and has a rectangular outline with two opposing broadsides 8, 8' which are confined  
16 by two longitudinal side edges or rims 10 and two broadside edges 12. At finished  
17 cushion body 2, the section piece 4 is bent at one of its broadsides 8, with the two  
18 ends 14 adjoining the edges 12 being connected to each other such that the  
19 structure formed from the section piece 4 has an enclosed outline in a cross  
20 sectional plane or plane of curvature parallel to the curved longitudinal side edges  
21 10.

1           When selecting the material strength of the section piece 4, the deformability  
2 of the used paper or used cardboard is taken into consideration so that the section  
3 piece 4 will not snap or buckle even along those areas which are significantly bent  
4 In the event these areas are is subjected to pressure loads or shock impacts that  
5 are commonly encountered during handling of objects protected by cushion bodies.  
6 During a deformation of the section piece 4 by impacting pressure loads or shocks,  
7 the elastic restoring force causes the cushion body 2 to revert to its original shape.

8  
9           In a most simple embodiment, the cushion body 2 is made of a section piece  
10 4 in which only the ends 14 are connected to each other, as e.g. shown in FIG. 8b  
11 in which the section piece 4 remains without deformation except for the bending of  
12 the ends. Such structures assume automatically a cross sectional configuration in  
13 which the sum of the tensions of the bent prestressed section parts are at a  
14 minimum. When being subjected to shocks, such a cushion body 2 absorbs the  
15 energy of the impact to effect an attenuation while at the same time partially storing  
16 the energy as reversible deformation energy and partially releasing the energy as  
17 frictional heat.

18  
19           This effect is even further promoted by shaping the strip 6 in its longitudinal  
20 direction in such a manner that the strip is compressed along areas of the  
21 longitudinal rim 10, as indicated by reference numeral 7. Thus, the strip 6 is

1 provided about its central portion 9 with an arching 11 which is of stable  
2 configuration to enable an effective attenuation of an object 32 being padded, and  
3 which allows a gentle contact upon the object 32 in view of its rounded areas.

4

5 Other deformations of the strips 6 are conceivable, too. In particular, a  
6 deformation at one edge or several edges in longitudinal direction of the strip 6 may  
7 result in an effective compression 7 of the strip 6. A compression sets the tension  
8 within the section piece 4. The deformation of the section piece 4 can be effected in  
9 dry, moist or hot-moist conditions, depending on the thickness and on the  
10 consistency of the strip 6. The firmer the consistency of the strip 6 the higher the  
11 resistance against a deformation in longitudinal direction and the stiffer the structure  
12 and the better the inherent attenuation effect.

13

14 A further important advantage of the deformation of the section piece 4 in  
15 longitudinal direction is the strong attenuating effect of the section piece 4 even in  
16 the event the connection of the broadside edges 12 in the region of the ends 14, 14'  
17 becomes loose. Even at detached ends 14, 14', the section piece 4 surrounds a  
18 large volume for cushioning the packaged object 32.

19

20 In order to ensure a stable connection of both ends 14 of the section piece 4,  
21 the ends 14 overlap in the embodiments of the cushion body 2 according to FIGS. 1

1 to 7, with the overlapping areas being glued together or held together through  
2 impressing. While in the embodiment of the cushion body 2 according to FIGS. 1  
3 and 5, two opposing broadsides 8, 8' of the section piece 4 bear upon each other in  
4 the area of the overlap of the ends 14, so that the cushion body 2 assumes a cross  
5 section piece of essentially ring-shaped contour, in the embodiments of the cushion  
6 body 2 according to FIGS. 2, 6 and 8b, the two opposing rims of a single broadside  
7 8 of the section piece 4 bear upon each other in the area of the overlap so that the  
8 cushion body 2 assumes a cross section piece in form of an essentially drop-  
9 shaped (guttiform) contour.

10  
11 While a glue joint or a press joint results in a fixed connection, both ends 14,  
12 14' of the section piece 4 can also be detachably connected to each other as shown  
13 in FIGS. 8 and 8a. The section piece 4 includes in the area of one of its ends 14 a  
14 slot 21 which extends in parallel relationship to the broadside edge 12 for receiving  
15 a tab 23 formed on the other end 14', with the tab 23 being interlocked in the slot 21  
16 through bending of one or more tab areas for secure attachment. Moreover, it is  
17 also possible, as shown in FIG. 8a, to punch in one of the two opposing broadside  
18 edges 12 a recess 44 in which a locking piece 45 formed on the other broadside  
19 edge 12' is engageable and hooked to mutually secure the broadside edges 12, 12'.  
20 The locking piece 45 may be formed through cuts 46, 46' into the broadside edge  
21 12' and then bent in direction towards the recess 44.

1           A locking may also be attained by punching a window 47 in one of the  
2       broadside 8, with a hook 49 projecting from the opposing broadside 8' through the  
3       window 47 for mutually locking the broadsides 8, 8'. Persons skilled in the art will  
4       understand that this type of locking mechanism can also be used in a cushion body  
5       2 as shown in FIG. 8b.

6

7           In order to increase the flexural strength of the arched section part while  
8       essentially retaining the bulk weight of the cushion body 2, either one or both rims  
9       10 of the section piece 4 may be beaded entirely or partially, as shown in FIGS. 1 to  
10      5 and 7, and indicated by reference numeral 16.

11

12          If desired, the cushion body 2, can be alternatively or additionally provided  
13      with score lines 18 extending, as shown in FIGS. 5 to 7, parallel to the rims 10 over  
14      a partial area of the broadsides 8 (FIG. 6) or over the entire length of the section  
15      piece 4 so as to completely surround the cushion body 2. The score lines 18 effect  
16      a bellows-like compression of the cushion body 2 perpendicular to the plane of  
17      curvature when the cushion body 2 is subjected to pressure loads or impact  
18      shocks, while being stiffened at the same time in a direction parallel to the plane of  
19      curvature.

20

21          Further, the section piece 4 can be provided with flat trough-shaped  
22      depressions 19, as shown in FIG. 4 which particularly reinforce the arched

1 section part 22 to resist a snapping thereof.

2

3 While cushion bodies 2 of small size are produced in shapes as shown e.g.

4 In FIGS. 1, 2, 5, 6 and 7 to enable a complete filling of hollow spaces between one

5 or more objects being packaged and the inside wall surfaces of a packaging

6 container, larger cushion bodies 2, as shown e.g. in FIGS. 3, 4, 7 and 9 serve as

7 edge protection or surface protection for objects being packaged. In this case, the

8 cushion bodies 2 have a cross section in form of a segment of a circle with an angle

9 at center of  $270^\circ$  in the embodiments of the cushion body 2 shown in FIGS. 3 and 9

10 for use as edge protection, or of  $180^\circ$  when the cushion body 2 is used as surface

11 protection as shown in shown in FIGS. 4 and 7 in which the overlapping ends 14 of

12 the section piece 4 form the flat section part 20 which connects the ends of the

13 semi-cylindrical section part 22. In the embodiment of the cushion body according

14 to FIGS. 3 and 9 which is used as edge or corner protection, the straight section

15 parts 26 abut the ends of the partially cylindrical section part 24 and meet in the

16 center axis 28 of the cushion body 2 at a right angle. The abutting ends 14 of the

17 section piece 4 extend from the center axis 28 towards the inside wall surface of the

18 section part 24 for support thereof.

19

20 Turning now again to FIG. 9, there is shown an object 32 which is packaged

21 in a box 30 with bottom 40 and lid 42. The object 32 is of block shape

1 and has perpendicularly abutting sides 34. In the nonlimiting example of FIG. 9, four  
2 cushion bodies 2 are arranged on at least two lateral sides 36 of the box 30 such  
3 that the partially cylindrical section parts 24 of the cushion bodies 2 bear upon a  
4 side wall 38 and upon the bottom 40 and lid 42 of the box 30 while both straight  
5 section parts 26 bear upon the corners of the sides 34 of the object 32. Although  
6 not shown in FIG. 9, the still exposed areas of the sides 34 of the object 32 may  
7 suitably be padded through placement of suitable cushion bodies 2 according to the  
8 embodiment shown in FIG. 4 which serve as surface protection, whereby the  
9 respective cushion bodies 2 bear with their straight section part 20 upon the object  
10 32 being packaged.

11

12 Referring now to FIGS. 10 to 13, there are shown various embodiments of  
13 an apparatus for making a cushion body according to FIGS. 2 or 6.

14

15 The apparatus includes essentially a mold, generally designated by  
16 reference numeral 48 and having two mold parts. One mold part represents the  
17 stationary female mold 50 with a U-shaped or V-shaped cavity 54, and the other  
18 mold part represents the ram 52 which is movable relative to the female mold into  
19 the cavity 54. A section piece 4 from the strip 6 of paper or cardboard is placed  
20 between the surface of the ram 52 facing the female mold 50 and a surface of the  
21 cavity 54 facing the ram 52 for subsequent bending in a U-shaped or V-shaped  
22 manner. If desired the section piece 4 can be provided with a



1 beading 16, with score lines 18 and/or with depressions 19.

2

3 The apparatus further includes a tacking tool 56 which is arranged in the  
4 area of the ends 14 of the bent section piece 4 that is pressed into the cavity 54 and  
5 essentially includes a pressure die or hob 58 which, after withdrawal of the ram 52  
6 from the cavity 54, is slideable transversely to the operating direction of the ram 52,  
7 as indicated by arrow 60, against an abutment 62 (FIGS. 10 to 12) or swingable  
8 (FIG. 13), so as to press the ends 14 of the section piece 4 which project beyond  
9 the cavity 54 against each other and to join them together.

10

11 While this type of press joint can be realized through respectively shaped  
12 surfaces of the pressure die or hob 58 and the abutment 62, a glued joint is  
13 obtained e.g. by coating the strip 6 initially on one side completely or partially with  
14 potassium water glass or with an adhesive e.g. hot melt adhesive. When using hot  
15 melt adhesive, the pressure die or hob 58 and the abutment 62 are heated to warm  
16 up the hot melt adhesive during the joining process. After cooling, the ends 14 are  
17 joined together.

18

19 FIG. 11 shows an arrangement in which the paper strip 6 required for  
20 shaping the cushion body 2 is wound on a take-off reel 64 from which the strip 6 is  
21 withdrawn by means of a feed unit, generally designated by reference numeral 66,

1 and supplied to the mold 48. The feed unit 66 intermittently advances the strip 6 in  
2 synchronism with the operation of the mold 48 and the operation of the tacking tool  
3 56 as well as with the operation of a knife 68 by which lengths of individual section  
4 pieces 4 are severed from the strip 6.

5

6 It is certainly possible, to temporarily store a plurality of section pieces 4 in a  
7 magazine preferably designed as changing magazine to allow single dispensing of  
8 the section pieces 4 and withdrawal by the feed unit for transport to the mold 48.  
9 Thus, the section pieces 4 are either separated from the strip 6 beforehand, i.e.  
10 prior to their transport to the mold 48 or punched from a not shown paper sheet or  
11 cardboard sheet.

12

13 In the embodiments as shown in FIGS. 10 and 11, the knife 68 is secured to  
14 the ram 52 for common movement transversely to the feed direction of the strip 6  
15 toward the mold 48. It is however also possible to separate the knife 68 from the  
16 ram 52, as shown in FIG. 12a in which the strip 6 is rolled off the take-off reel 64  
17 and supplied to the mold 48. In the apparatus according to FIG. 13, the strip 6 is  
18 advanced by the ram 52 into the cavity 54 of the female mold 50. For that purpose,  
19 the ram 52 has a stopper or engagement member 70 by which the strip 6 is pushed  
20 forward towards the female mold 50 and into the cavity 54. The section piece 4 is  
21 severed from the strip 6 when being disposed in the cavity 54.

1       The tacking tool 56 includes a clamping jaw 72 which is swingably mounted  
2   in the female mold 50 for rotation in direction of double arrow 61 and forms part of  
3   the surface of the cavity 54 during the advance of the ram 52. After retraction of the  
4   ram 52, the clamping jaw 72 is pivoted toward the abutment 62 for joining the ends  
5   14 of the section piece 4. The abutment 62 is suitably formed by the respective  
6   opposite wall surface of the female mold 50 defining the cavity 54.

7

8       After connecting the ends 14, the finished cushion body 2 can be  
9   discharged e.g. by means of an ejector 74 (FIG. 12a) transversely to the operating  
10   direction of the ram 52 and transversely to the feed direction.

11

12       Persons skilled in the art will understand that FIGS. 10-13 show only  
13   simplified, schematic illustrations of an apparatus according to the present invention  
14   in order to describe a principal way of making cushion bodies according to the  
15   present invention. The apparatus certainly includes much additional mechanical  
16   elements which are however not shown in the Figures for sake of simplicity.

17

18       Turning now to FIG. 16, there is shown a further variation of a cushion body  
19   2 according to the present invention. This especially effective cushion body 2 is of  
20   pot-shaped configuration with a wall 82 closed by a bottom 78 which

1 may be flat or arched as indicated by broken line 79. If provided with an arched  
2 bottom 78, the arching 79 bulges outwards in direction away from the inner space  
3 80. The wall 82 is provided with folds 84 which generally extend irregularly over the  
4 wall 82 but run essentially parallel to a longitudinal axis extending through the pot-  
5 shaped cushion body 2 from an upper rim 86 in direction towards the bottom 78.  
6 These folds 84 provide the wall 82 with an elasticity to thereby accomplish an  
7 optimum padding of the object 32 being packaged, with the stiffness of the cushion  
8 body 2 being created by the bottom 78.

9

10 As shown in FIG. 16, the upper rim 86 can be provided in form of peaks 90  
11 with pockets 92 formed therebetween. The number of peaks 90 depends on the  
12 configuration of a blank 88 (FIG. 15) which is separated from a strip 6. This blank  
13 88 may be formed as a rectangular or square section piece 4 of the strip 6, with four  
14 corners forming the peaks 90 after shaping the blank 88 (i.e. section piece 4) into a  
15 pot-shaped cushion body 2.

16

17 It is however also possible to cut from the strip 6 a circular blank 88 which is  
18 formed into a pot-shaped cushion body 2. In this case, the wall 82 of the pot-shaped  
19 cushion body 2 does not terminate in peaks at the bottom-distant end but terminates  
20 in a circular rim extending approximately parallel to the bottom 78.

1        This pot-shaped cushion body 2 is characterized not only by a superior  
2   ability to cushion an object being packaged but has also significant advantages in  
3   connection with a cost-efficient production, as will now be described with reference  
4   to FIG. 15 which shows an apparatus for making a pot-shaped cushion body 2,  
5   generally designated by reference numeral 94. The apparatus 94 includes a take-  
6   off reel 64 onto which the strip 6 is wound for making the cushion bodies 2. The  
7   strip 6 is transported along a guide path 96 in direction to a deformation bore 98  
8   which defines a longitudinal axis 102 extending vertical through a base plate 100.

9  
10       Lowered into this deformation bore 98 in direction of the longitudinal  
11   axis 102, as indicated by arrow 63, is a movable ram 104 of a cross section which is  
12   smaller than the cross section of the deformation bore 98 by about double the  
13   thickness of the strip 6. In the nonlimiting illustration of FIG. 15, the deformation  
14   bore 98 as well as the ram 104 have a circular cross section, however, other cross  
15   sections are certainly possible.

16  
17       The ram 104 is provided with a not shown drive for traveling into the  
18   deformation bore 98. The drive is suitably dimensioned to effect, during penetration  
19   of the ram 104 into the deformation bore 98, a deformation of the blank 88, into a  
20   pot-shaped cushion body 2. The blank 88 is severed by a knife 106 from the strip 6  
21   which advances in direction of the guide path 96. The

1 knife 106 is movable in vertical direction transversely to the direction of the guide  
2 path 96. At its lower end which faces the base plate table 100, the knife 106  
3 includes a blade 108 which enters during downward operation of the knife 106 a  
4 guide slot 110 while at a same time severing the blank 88 from the strip 6. Suitably,  
5 the ram 104 is lowered in direction towards the base plate 100 until its lower end  
6 112 facing the base plate 100 holds the strip 6 onto the base plate 100. Immediately  
7 after being sheared off, the blank 88 is pressed by the ram 104 into the deformation  
8 bore 98 for formation of a pot-shaped cushion body 2.

9

10 Suitably, the ram 104 travels into the deformation bore 98 until the  
11 pot-shaped cushion body 2 is ejected from the deformation bore 98 through an  
12 outlet 114 at the opposite end of the bore 98, distant to the guide path 96.

13

14 Depending on the type of the desired cushion body, the ram 104 may  
15 include a flat lower end 112, as shown in FIG. 15. However, in case the bottom 78  
16 should assume the shape of an arch 79, the lower end 112 of the ram 104 is  
17 respectively rounded.

18

19 Instead of cutting the strip to size by the knife 106, it is also possible to  
20 substitute the knife 106 above the guide path 96 by a not shown punch by which  
21 circular or differently shaped blanks 88 are cut out. The blanks 88 are then fed in

1 direction towards the ram or punch 104 and shaped within the deformation bore 98.  
2 Moreover, it is possible, to influence the precise configuration of the pot-shaped  
3 cushion body 2 by means of a punch press, shown in FIG. 17 and generally  
4 designated by reference numeral 115. The punch press 115 includes a ram 104  
5 which is movable up and down relative to a deformation bore 98 provided in the  
6 base plate 100. The deformation bore 98 is provided at its upper end 116 facing the  
7 guide path 96 as well as at the opposing lower end 118 with shaping dies 120, 122.  
8 By means of the upper shaping dies 120, the cross section or shape of an upper  
9 inlet 124 of the deformation bore 98 can be defined, e.g. in form of an octagon. In a  
10 similar manner, the shaping die 122 can be prepared in a desired shape, e.g.  
11 circular. A selection of these shaping dies 120, 122 is provided by push-in plates  
12 126 which are respectively guided e.g. in slots 128 in the upper end 116 and in the  
13 lower end 118 of the deformation bore 98.

14

15 In this manner, it is possible through exchange of the push-in plates 126 to  
16 produce pot-shaped cushion bodies 2 of different configuration. It is also possible to  
17 provide a ram 104 with an exchangeable lower end 112. For this purpose, the ram  
18 104 may be provided at its end facing the deformation bore 98 with an arched  
19 deformation piece 130 which is fastened to shaft 132 of the ram 104. Depending on  
20 the configuration of the desired bottom 78, the deformation piece 130 can be  
21 selected and mounted to the shaft 132.

1           It is also possible to provide the push-in plates 126 at the upper end 116 with  
2 a greater opening than in the area of the lower end 128. Furthermore, the upper end  
3 116 of the push-in plate 126 may be configured in a particular manner to effect the  
4 configuration of the folds 84 as shown in FIG. 16. For example, in case of an even  
5 distribution of the corners, e.g. in form of an octagon 134 as shown in FIG. 18, it is  
6 possible to distribute the folds 84 evenly over the entire circumference of the wall  
7 surface 82.

8

9           Upon use of a broader paper strip and use of strip cutters and parallel  
10 arrangement of several apparatuses, many cushion bodies 2 can be produced at  
11 the same time. Moreover, the cushion bodies 2 can be produced at a higher rate  
12 also in a rotational machine - analogous to the cycle operation.

13

14           Turning now to FIG. 14, there is shown an extruding unit, generally  
15 designated by reference numeral 136 for forming a strip 6 of particular composition.  
16 The extruding unit 136 includes a press 138 with two drums 140, 142 which are  
17 rotatably supported for rotation about two parallel shafts 144, 146. The distance  
18 between the shafts 144, 146 is selected in dependence of the diameter of the  
19 drums 140, 142 to form a gap 148 between both drums 140, 142 in which raw  
20 material is advanced by a conveyor 150 and pressed to a strip 6. At the receiving  
21 end of the conveyor 150 is a reservoir 152 which contains pure grades of paper



1 wastes. The conveyor 150 receives the material from the reservoir 152 and blends  
2 the pure grades of paper waste with a binder, e.g. sodium water glass or adhesive.  
3 This binder is fed onto the conveyor 150 from a suitable funnel-shaped container  
4 154 arranged downstream of the reservoir 152.

5  
6 The raw material made from this mixture is transported by the conveyor 150  
7 in direction of the gap 148 and introduced into the gap 148 by a transfer mechanism  
8 156 for shaping the raw material into the strip 6. The configuration of the gap 148 is  
9 crucial for shaping the strip 6 which can either be flat or arched. Especially arched  
10 strips 6 are used for making cushion bodies according to FIG. 8b (these cushion  
11 bodies may however also receive their shape through pressing).

12  
13 The strip 6 formed in the gap 148 is transported away via a guide roller  
14 arrangement 158 from the press 138, for example in direction towards the base  
15 plate 100.

1        While the invention has been illustrated and described as embodied in a  
2 cushion body, and method and apparatus for making a cushion body, it is not  
3 intended to be limited to the details shown since various modifications and structural  
4 changes may be made without departing in any way from the spirit of the present  
5 invention.

6

7        What is claimed as new and desired to be protected by Letters Patent is set  
8 forth in the appended claims:

1 **CLAIMS**

2 I claim:

1 1. A cushion body, in particular for use as filler material in packagings or as edge  
2 protection and/or surface protection for objects being packaged, comprising a  
3 section piece of a flat strip or sheet of paper or cardboard, formed to a spatial  
4 structure with shock absorbing properties.

1 2. A cushion body of claim 1 wherein the strip or sheet is made at least partially  
2 of recycled paper or recycled cardboard.

1 3. The cushion body of claim 1 wherein the structure is elastically deformable.

1 4. The cushion body of claim 1 wherein said section piece has at least one bent  
2 section part.

1 5. The cushion body of claim 1 wherein said section piece includes a spatial  
2 deformation in longitudinal direction.

1 6. The cushion body of claim 5 wherein said section piece has an arched central  
2 part and is defined in longitudinal direction by longitudinal edges which are  
3 compressed relative to said arched central part.

1 7. The cushion body of claim 1 wherein said structure has a cross section in  
2 form of an enclosed outline.

1 8. The cushion body of claim 1 wherein said section piece has two ends joined  
2 together.

1 9. The cushion body of claim 1 wherein said structure has a cross section in  
2 form of an essentially ring-shaped outline.

1 10. The cushion body of claim 1 wherein said structure has a cross section in  
2 form of an essentially guttiform outline.

1 11. The cushion body of claim 10 wherein said structure has an arched central  
2 part and broadside edges which are joined together over their entire width, said  
3 structure having longitudinal edges between which said arched central part is  
4 situated which is compressed in the area of said longitudinal edges.

1 12. The cushion body of claim 1 wherein said structure includes a section part  
2 which is bent to a segment of a circle and has two ends, and at least one  
3 straight section part which adjoins the ends of the bent section part.

1 13. The cushion body of claim 12 wherein said structure has a cross section in  
2 form of an enclosed semi-circular outline.

1 14. The cushion body of claim 12 wherein said bent section part is defined by a  
2 center, said structure having two straight section parts abutting each other at a  
3 right angle in the center of said bent section part.

1 15. The cushion body of claim 14 wherein both straight section parts extend to an  
2 inside surface of said bent section part.

1 16. The cushion body of claim 1 wherein said structure is of pot-shaped  
2 configuration with elastically deformable walls.

1 17. The cushion body of claim 16 wherein said walls surround a stiff bottom.

1 18. A method of making a cushion body for use as filler material or as edge  
2 protection and/or surface protection during packaging of objects, in particular  
3 for making cushion bodies, comprising the steps of making a cushion body of  
4 paper or cardboard on site of packaging an object.

1 19. The method of claim 18 wherein said making step includes separating a  
2 section piece from a flat strip or sheet of a material selected from the group  
3 consisting of paper and cardboard; and forming the section piece into a three-  
4 dimensional structure with shock-absorbing properties.

1 20. The method of claim 19 wherein said separating step includes severing said  
2 section piece from a rolled up strip before or during said forming step.

1 21. The method of claim 19 wherein said forming step includes bending the  
2 section piece in an essentially U-shaped configuration over one broadside of  
3 the section piece.

1 22. The method of claim 21 wherein said bending step includes joining together  
2 two ends of the section piece.

1 23. The method of claim 19 wherein said forming step includes pressing the  
2 section piece into a shaping deformation bore by a ram to assume the shape  
3 of a pot.

1 24. The method of claim 23 wherein said pressing step includes cutting to size a  
2 blank from a strip and shaping the blank in the deformation bore by the ram.

1 25. The method of claim 24 wherein said cutting step includes holding the strip by  
2 the ram in the area of the deformation bore and cutting out the blank by a  
3 punch.

1 26. The method of claim 23 wherein said pressing step includes adjusting the  
2 cross section of the deformation bore to suit a desired configuration of the pot  
3 of the section piece.

1 27. The method of claim 23 wherein said pressing step includes adjusting the  
2 lower end of the ram to suit a desired configuration of the bottom of the  
3 pot-shaped section piece.

1 28. The method of claim 26 wherein said adjusting step includes limiting the free  
2 cross section of the deformation bore by shaping dies.

1 29. Apparatus for making a cushion body for use as filler material or as edge  
2 protection and/or surface protection during packaging of objects, in particular  
3 for making cushion bodies, comprising at least one mold having at least two  
4 mold parts movable relative to each other for shaping a section piece of a strip  
5 or sheet of paper or cardboard into a three-dimensional structure with shock  
6 absorbing properties.

1 30. The apparatus of claim 29 wherein one of said mold parts is a female mold  
2 including a cavity, and the other one of said mold parts is a ram for pressing  
3 the section piece into said cavity of said female mold.

1 31. The apparatus of claim 30 wherein said cavity is of essentially U-shaped or V-  
2 shaped cross section.

1 32. The apparatus of claim 29, further comprising at least one take-off reel for  
2 supply of a rolled-up strip of paper or cardboard.

1 33. The apparatus of claim 29, further comprising a knife for separating the  
2 section piece from the supplied strip.

1 34. The apparatus of claim 33 wherein said knife is rotatable and movable  
2 transversely to a feed direction of the strip.



1 35. The apparatus of claim 34 , further comprising a feed unit for advancing the  
2 strip or the section piece.

1 36. The apparatus of claim 35 wherein said feed unit is synchronized with the  
2 operation of said mold.

1 37. The apparatus of claim 36, further comprising an ejector for removing a  
2 finished cushion body from said mold.

1 38. The apparatus of claim 30, further comprising a base plate for housing said  
2 female mold, said base plate being traversed by a deformation bore, said ram  
3 being slidably supported for movement in direction towards said deformation  
4 bore, with a blank being arranged between said ram and said deformation  
5 bore.

1 39. The apparatus of claim 38 wherein said ram is moved in an operating  
2 direction, said deformation bore and the operating direction of said ram  
3 extending in vertical direction.

1 40. The apparatus of claim 38 wherein the strip is guided between said ram and  
2 said deformation bore upon a guide path extending over said base plate.

1 41. The apparatus of claim 38, further comprising a knife situated upstream of  
2 said ram in conveying direction of the strip for cutting the strip to size, said  
3 knife including a control mechanism for operating said knife in dependence of  
4 the operation of said ram.

1 42. The apparatus of claim 41 wherein said base plate is provided with a slot for  
2 receiving a blade of said knife during cutting operation of said knife.

1 43. The apparatus of claim 38 wherein said deformation bore has a cross section  
2 to allow formation of a pot-shaped structure of desired configuration.

1 44. The apparatus of claim 38 wherein said deformation bore is provided with at  
2 least one template for adjusting its cross section, said template being secured  
3 within the cross section of said deformation bore.

1 45. The apparatus of claim 38 wherein said template is configured in form of a  
2 push-in plate guided in a slot which extends through said base plate  
3 transversely to the longitudinal direction of said deformation bore.

1 46. The apparatus of claim 38, further comprising a push-in plate provided at an  
2 inlet at one end of said deformation bore facing said ram and defined by a  
3 cross section which differs from a cross section of a push-in plate arranged at  
4 the opposing lower end of said deformation bore.

1 47. The apparatus of claim 38 wherein said deformation bore has a lower end  
2 serving as discharge opening for ejecting a finished structure.

1 48. The apparatus of claim 38 wherein said structure has a bottom, said ram being  
2 provided with a lower end which faces said deformation bore and has a  
3 configuration complementary to a desired configuration of the bottom of said  
4 structure.

1 49. The apparatus of claim 48 wherein said lower end is rotatably supported.

1 50. The apparatus of claim 46 wherein said inlet is configured as polygon with at  
2 least four corners, with the lower end of said ram including a circular die.

1 51. The apparatus of claim 38 wherein said ram executes a movement relative to  
2 said deformation bore along a circular path.

1 52. Apparatus for making a strip to produce cushion bodies, comprising two drums  
2 arranged in superimposed relationship to form a gap therebetween of a cross  
3 section adapted to form a strip, a conveyor for transporting said strip through  
4 the gap between said drums, and a transfer unit in the area of said gap for  
5 receiving the strip from said conveyor.

1 53. The apparatus of claim 52 wherein both drums apply pressure upon the strip  
2 in the area of the gap.

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